



OAR and ORD Collaboration to Measure the Benefits of Air Quality Regulations – “Accountability”

research
and
development

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Science Questions

- How can specific improvements in public health be solely attributed to air quality regulations?
- What indicators should be used to measure improvements in public health?
- How should analyses address the many gaps in data for measuring improvements?
- What methods should be used to conduct these analyses?

Research Goals

OAR and ORD are supporting a multi-faceted approach to:

- Develop a framework for accountability research,
- Develop methods for accountability studies,
- Conduct case studies of natural experiments,
- Conduct before and after studies to evaluate policy actions,
- Develop indicators of health improvement, and
- Examine how currently available data can be used and/or supplemented to conduct accountability research.

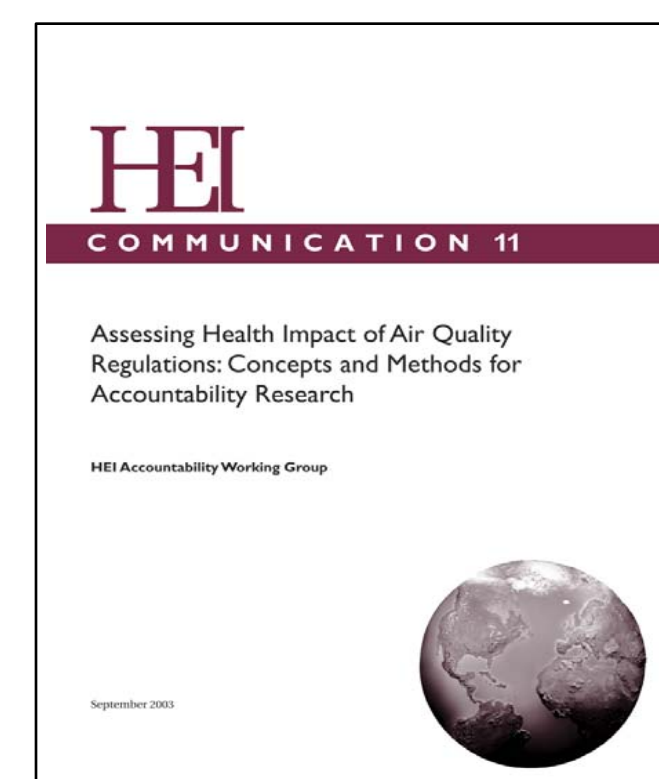
Why is Accountability Research Important?

- Between 1990-2010 the annualized cost of air pollution control is about \$20 billion/year.
- EPA needs to demonstrate to policy makers, legislators, industry, and the public how past efforts to reduce air pollution have yielded benefits and that future efforts will continue to do so.

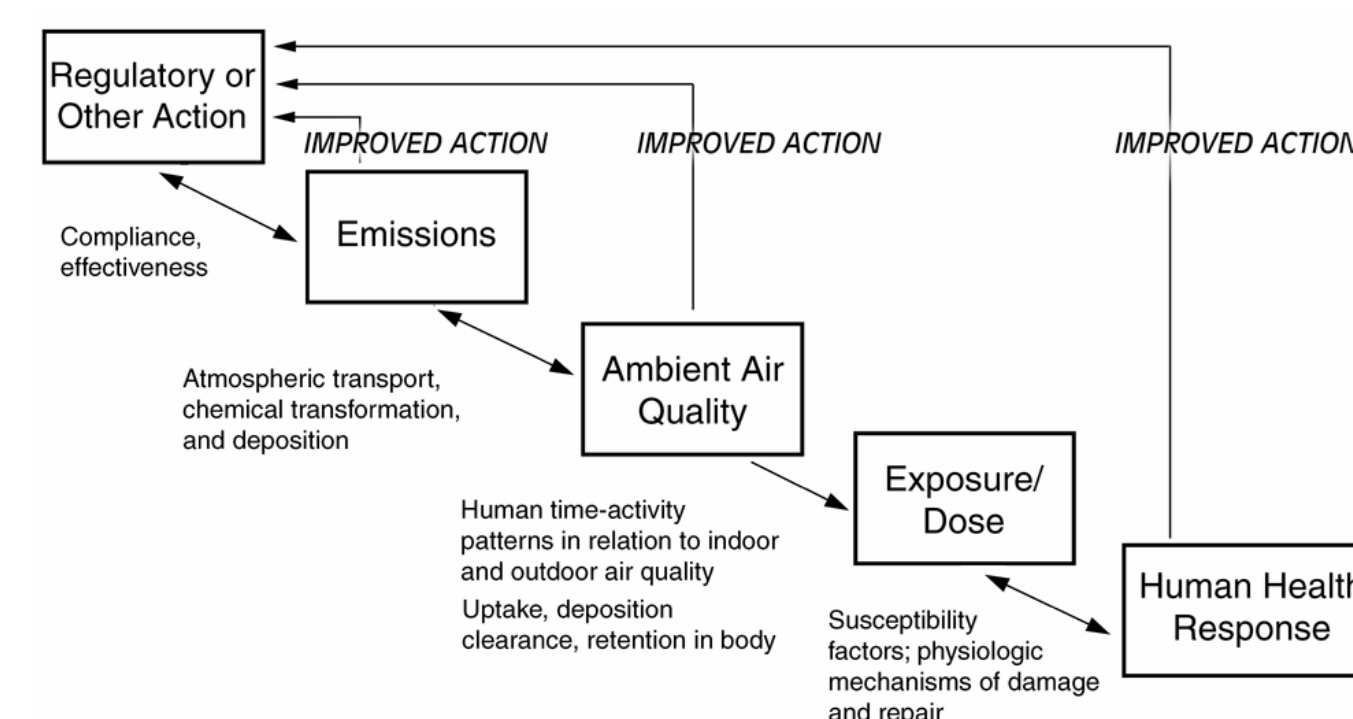
Health Effects Institute: Assessing Health Impact of Air Quality Regulations

Concepts and Methods

- Multi-authored monograph published September 2003
- Conceptual framework for future research
- Research Directions



Conceptual Framework: The Chain of Accountability



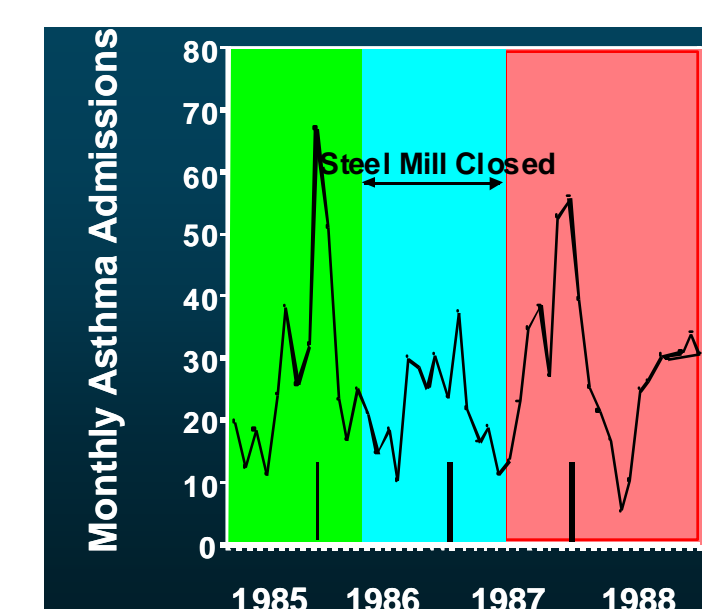
Research Directions

HEI has initiated a research program to:

- Identify targets of opportunity to track the effects of regulatory interventions,
 - Develop methods, and
 - Support cooperative efforts to conduct surveillance.
- HEI is currently funding three accountability studies in Ireland, Germany and England.

Utah Valley: A Natural Experiment

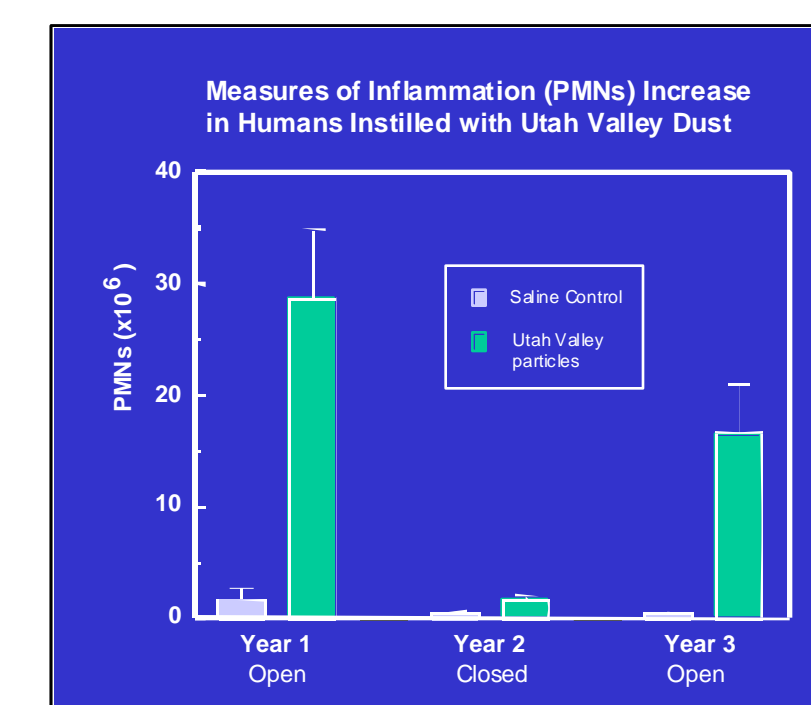
EPA took advantage of a unique opportunity to analyze the effects on health of a change in ambient PM burden in the Utah Valley that arose from the closing and reopening of a steel mill between 1985 to 1988. Emissions from the mill were more than 80% of the contribution from industrial activity in the Valley.



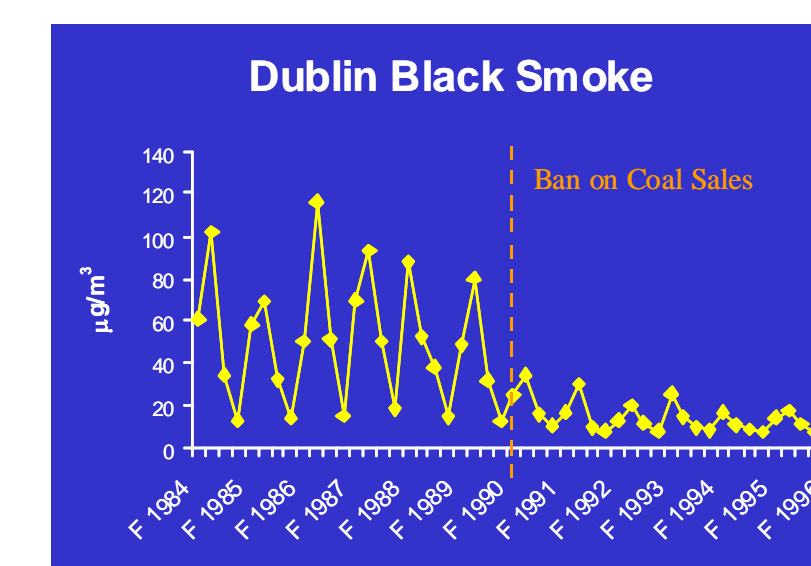
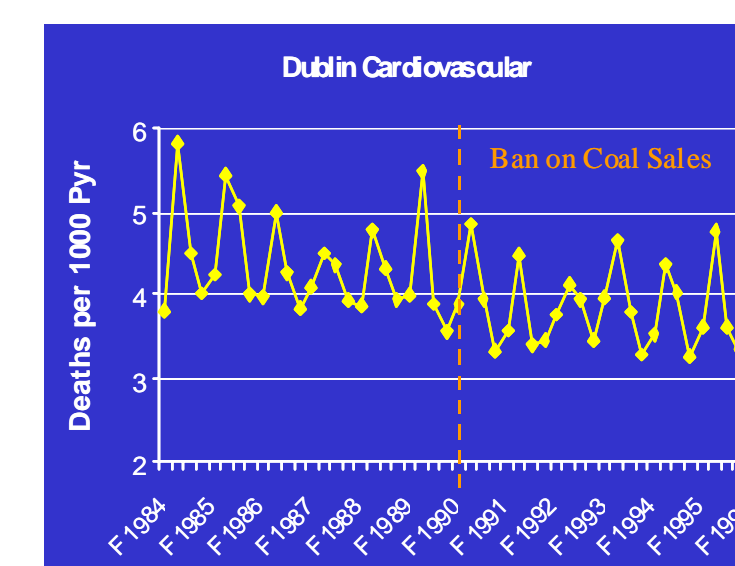
Epidemiology studies at Brigham Young University reported an improvement in health status when the steel mill closed and PM levels dropped.

EPA scientists conducted human, animal and in-vitro studies on Utah Valley particles confirming the epidemiology studies and found that:

- Inflammation levels were more severe from particles collected when the plant was operating, and
- Particles collected while the mill was operating were ten times more toxic than particles collected from other locations and applied at comparable dose levels.



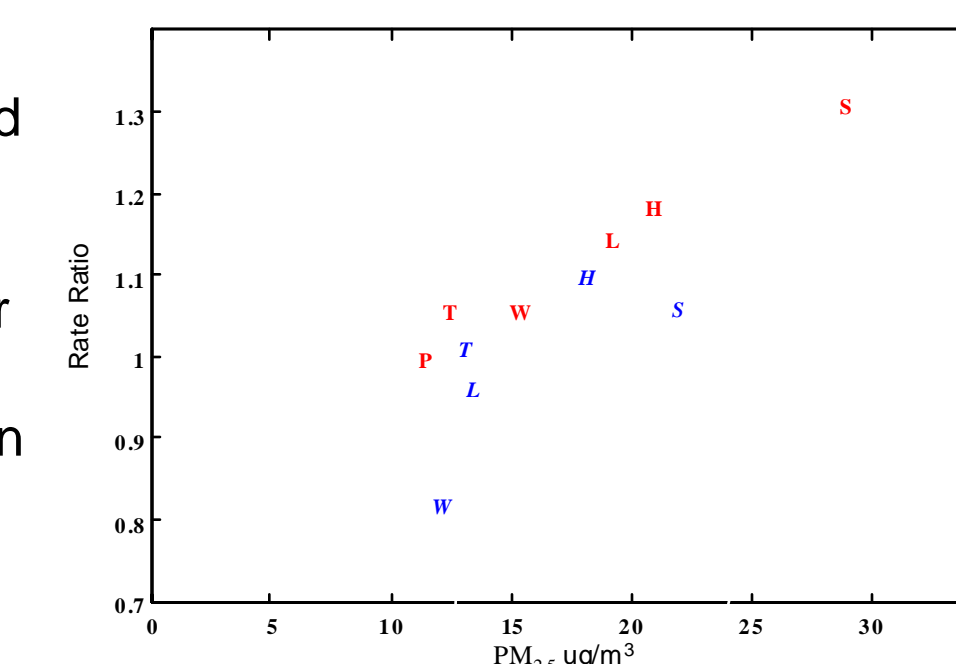
The Dublin Study: Evaluating the Impact of Air Pollution Regulation



- Researchers examined the effect on mortality of banning the marketing, sale and distribution of coal in Dublin on Sept 1, 1990.
- The study compared levels of black smoke (BS), Sulfur Dioxide (SO₂) & mortality indices 72 months before and after the ban.
- Adjusted respiratory and cardiovascular death rates declined by 15.5% (95% CI 12% - 19%) and 10.3% (95% CI 8% - 13%), respectively, coincident with the pollution reduction.

The Harvard Six Cities Study: Tracking Health Responses with Reductions in Air Pollution

Follow-up of the Harvard Six Cities adult cohort was extended for eight years. Mortality rate ratios in both time periods were estimated relative to Portage for each city and compared. Generally, the city-specific mean PM_{2.5} was lower during 1990-1998 (estimated using publicly available data) compared to 1979-1989 (measured directly). City-specific mortality rate ratios decreased between the first and second periods in parallel with the decrease in PM_{2.5} pollution.



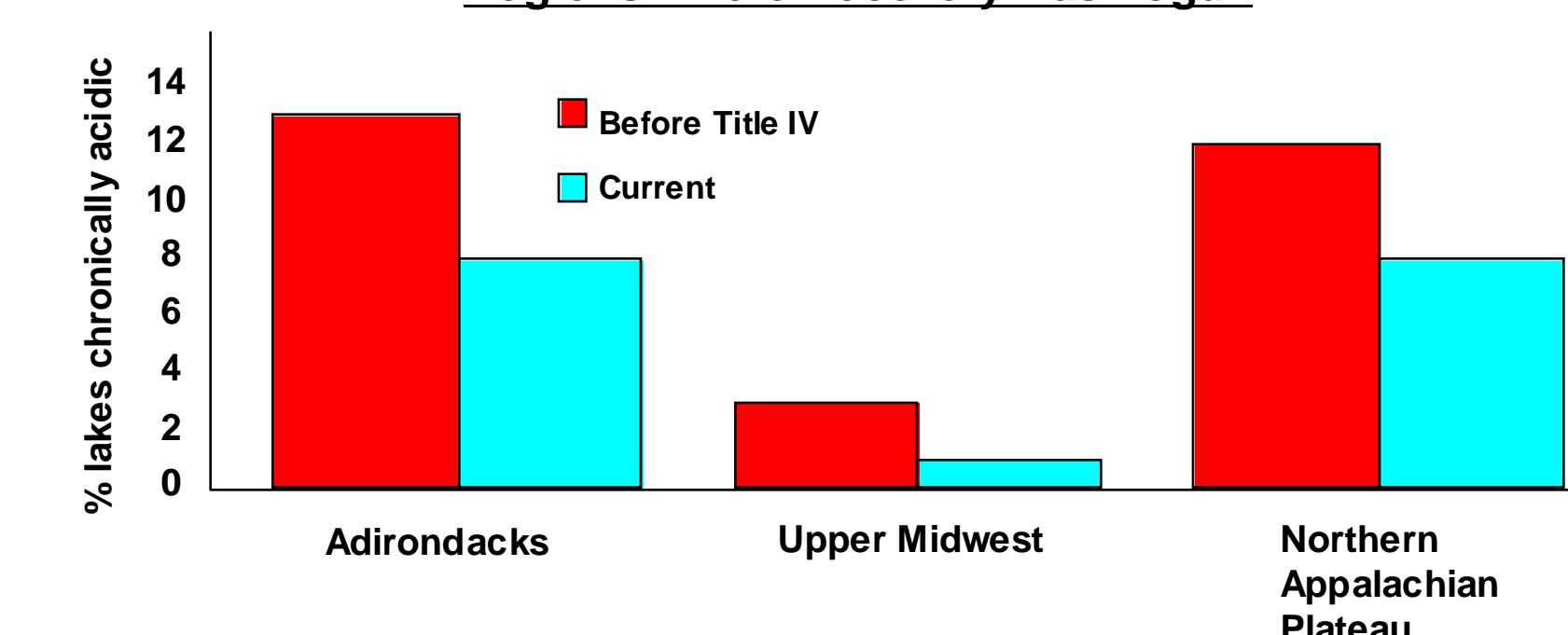
Estimated adjusted rate ratios and PM_{2.5} levels in the Six Cities by period (1979 – 1989, 1990 – 1998). P denotes Portage, WI; T Topeka, KS; W Watertown, MA; L St. Louis, MO; H Harriman, TN; S Steubenville, OH.

Ecosystem Protection Research: Demonstrating the Effectiveness of the Clean Air Act



- Regional declines in surface water sulfate measured by the TIME/LTM program can be directly linked to declines in emissions and deposition of sulfur

Regions Where Recovery Has Begun



- New England, Adirondack, and Upper Midwest Lakes, and Appalachian Streams show significant trends in decreasing sulfate concentrations and in increasing acid neutralizing capacity (NE lakes no ANC trend)
- Recovery of the most acidic waters is a measure of success of the Clean Air Act Amendments
- Data supported “Cap and Trade” as viable approach for use in President’s Clear Skies Initiative

Future Directions

- EPA rules will affect public health over the next 10 years and longer:
 - Nonroad Diesel Rule (2004)
 - Clean Diesel Truck and Bus Rule (2000)
 - Tier 2 Vehicle & Gasoline Sulfur Program
 - Nonattainment designations for ozone & PM_{2.5} (2004) & state implementation plans
 - Review of PM NAAQS (September, 2006)
 - Clean School Bus Demonstration Projects
 - Other proposed rules
- EPA will undertake a systematic effort to track air quality achievements and evaluate air program results.
- Additional research will focus on:
 - OAR/ORD feasibility study to survey national-scale human activity and awareness of the Air Quality Index.
 - Biological markers of exposure and effects to assess and establish links for air pollution and health and ecological effects.

Impact and Outcomes

Accountability research will be used to:

- Evaluate the effectiveness of air quality rules designed to protect public health.
- Support policy decisions concerning the need for additional protections.
- Evaluate the effectiveness of air quality rules designed to protect ecosystem health.
 - Understand why ecosystems are or are not responding to emission controls (i.e., ecosystem processes) and evaluate progress toward goals to improve/protect ecosystems?

Source to Health Outcome